

THE SYSTEMATICS OF THE GENUS *PACHYSTACHYS* (ACANTHACEAE)

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Abstract.—In 1847, Nees von Esenbeck described the genus *Pachystachys* with a single species, *P. riedeliana*, from Brazil. Later that same year, he published six additional species including *P. coccinea* (Aublet) Nees, a species that has long been confused with *P. riedeliana*. Although the two species are superficially similar, they can readily be separated by the longer, linear calyx segments of *P. coccinea*. Recent field activities in South America have shown that in number of species and in morphological diversity, the genus reaches its zenith in Amazonian Peru. Nine new taxa are currently proposed, whereas four of Nees' six species are reduced to synonymy. The genus is characterized by a prominent terminal spike of flowers with large, ringent, two-lipped corollas and two stamens that are about as long as the corolla, having equal, deeply sagittate anthers. Several species (*P. coccinea*, *P. spicata*) have been observed to be hummingbird pollinated, and the inflorescences of two additional species (*P. ossolaea*, *P. puberula*) are extensively covered with ants. However, floral morphology appears to preclude myrmecophily as a factor in the pollination system of the red-flowered rain-forested species of *Pachystachys*. All taxa have been studied in depth, including their pollen morphology, and analytical keys to the species have been prepared to facilitate the identification of the 12 species recognized in this treatment. The data from pollen morphology show only slight variation in the pollen of species of *Pachystachys* and support the retention of the genus in Bremekamp's (1938) tribe Odontonemeae subtribe Graptophyllinae.

The genus *Pachystachys* Nees is a Neotropical genus of 12 species. A member of the subfamily Acanthoideae (=Imbricatae Lindau, 1893), these plants occur along edges of the lowland rainforest at relatively low elevations (below 1000 meters) from the West Indies southward to Peru and Bolivia and eastward to French Guiana and Amazonian Brazil.

Members of *Pachystachys* are perhaps best known for their ornamental beauty, and many may be found in botanical gardens throughout the warmer regions of the world. Their prominent terminal spikes with bright red flowers are an impressive sight when the showy inflorescences reach full anthesis, and

these shrubs or subshrubs are highly prized in the garden.

Recent field activities in South America have shown that in number of species and in morphological diversity, the genus reaches its zenith in Amazonian Peru. Since attempts to determine specifically the material from these collections proved unsatisfactory, I have decided to present a basic revision of the genus.

History

In 1847, Nees von Esenbeck described the genus *Pachystachys* with a single species, *P. riedeliana*, from Amazonian Brazil. Later that same year in de Candolle's *Prodro-*

mus he published six additional species including *P. coccinea*, originally described as *Justicia coccinea* by Aublet in his "Histoire des plantes de la Guiane françoise" in 1775.

A second epithet, *Justicia spicata*, published by Ruiz & Pavon (Fl. Peruv. & Chil. Prodr. 1798) and based on one of their own collections from Peru, was cited by Nees in his second publication in synonymy under *P. riedeliana*. Unfortunately, this earlier epithet (1798) has priority over *riedeliana* (1847), and therefore *P. spicata* becomes the correct name for this species.

No further additions were made to the genus until 1947, when Carlos Rizzini described *P. albiflora* from Brazil. This species, collected in Acre, is synonymous with *P. lutea* from nearby Amazonian Peru.

Morphology

The plants are suffrutescent and climbing and are between 1 and 3 meters tall, with relatively large, entire or undulate, petiolate leaves. Their prominent terminal flowering spikes are often large and conspicuous, with variously shaped and colored bracts and with bright red, pinkish-red or white corollas. The large, showy corollas are ringent, slenderly obconic, curved, and two-lipped. The upper lip is usually erect or recurved, narrow and bilobed, whereas the lower lip is three-lobed, the lobes spreading, subequal, oblong or ovate. There are two fertile stamens; these are about as long as the upper corolla lip and are attached near the base of the corolla tube. Both anthers are deeply sagittate, with the sacs equal and muticous at the base. The pollen of *Pachystachys* is the typical tricolporate, subprolate pollen characteristic of the tribe Odontonemeae. Here each colpus is flanked on either side by a pseudocolpus of approximately equal length. The colpi rarely fuse at one or both poles, whereas the pseudocolpi converge and are fused into three pairs just below the poles. The surface is commonly reticulate. While the pollen is

slightly variable, the variation does not appear to be taxonomically significant.

The red floral colors seem to suggest that the flowers are largely adapted to hummingbird-pollination, and indeed this is what I have personally observed in several of the species. Furthermore, nectar appears to be secreted by a cushion-like nectary which surrounds the base of the ovary. Another interesting phenomenon that I have observed is that the inflorescences of most specimens of *Pachystachys*, as well as certain species of *Aphelandra* and *Ruellia*, are extensively covered with ants and homopterous insects. It appears that the ants feed on the honeydew exudate produced by the armored scales and in return protect the plants from other indiscriminate feeders.

Like most Acanthaceae, these taxa are of extreme local distribution in undisturbed forests and are rarely collected in secondary growth. There is no doubt in my mind that, as more field work is being undertaken in relatively uninhabited areas of Peru, additional taxa will be discovered. Furthermore, the genus appears to be well suited for reproductive biology studies, especially pollinator relationships and seed dispersal.

Taxonomy

Pachystachys Nees in Mart. Fl. Bras. 9:99. 1847. Type species: *Pachystachys riedeliana* Nees.

Herbaceous or suffrutescent plants; leaves large, petioled; spikes terminal, dense; bracts conspicuous, herbaceous; bractlets small or none; flowers borne in terminal spike of verticillasters consisting of 3 or 4 flowers each; calyx 5-parted, the segments relatively short; corolla ringent, slenderly obconic, curved, 2-lipped, upper lip narrow, 2-lobed at tip, lower lip 3-lobed, lobes subequal, oblong or ovate; stamens 2, about as long as corolla, attached near base of its tube; anthers deeply sagittate, basal lobes muticous, equal; staminodes, if present, rudimentary; capsule 4-seeded.

Key to the Species of *Pachystachys*

1. Corolla white; bracts bright yellow or orange yellow *P. lutea*
1. Corolla red, crimson, pinkish-red or pink; bracts green, yellowish-green, green with purple at tips or brownish red 2
 2. Bracts 3–4.5 cm long 3
 3. Bracts elliptic-ovate, 15–17 mm wide *P. longibracteata*
 3. Bracts oblanceolate, 6–8 mm wide 4
 4. Leaf blades oblong to ovate, 8–8.5 cm wide; spikes 6–10 cm long; bracts 7–8 mm wide, terminated by mucro about 1 mm long, principal veins not prominent *P. schunkei*
 4. Leaf blades elliptic to oblong, 11–14.5 cm wide; spikes 19–20 cm long; bracts 6–7 mm wide, not terminated by mucro, three principal veins prominent *P. fosterii*
 2. Bracts less than 3 cm long 5
 5. Bracts brownish-red, lanceolate, 0.8 cm long, 1.5 mm wide *P. badiospica*
 5. Bracts green, yellowish-green or green with purple at tips, lanceolate, oblanceolate, ovate or narrowly elliptic, 1.5–2.8 cm long, 6–18 mm wide .. 6
 6. Corolla 3.5–4 cm long 7
 7. Bracts yellowish-green, membranous, sparingly glandular-pilose; corolla pink, upper lip erect *P. incarnata*
 7. Bracts dark-green, not membranous, densely puberulous; corolla crimson, upper lip recurved *P. puberula*
 6. Corolla 5–7.5 cm long 8
 8. Calyx segments narrowly triangular, 3 mm long, 1 mm wide . *P. spicata*
 8. Calyx segments lanceolate, 5–10 mm long, 0.5–1.5 mm wide 9
 9. Calyx 9–12 mm long, segments 8–10 mm long; corolla pink, pinkish-red or orange-red 10
 10. Bractlets minute, 2 mm long, 0.4 mm wide, glabrous; bracts narrowly ovate, 2.2–2.5 cm long *P. roseus*
 10. Bractlets 11 mm long, 1.25 mm wide, pilose; bracts broadly elliptic, 1.7 cm long *P. killipii*
 9. Calyx 5.5–7 mm long, segments 5 mm long; corolla bright red or crimson 11
 11. Bracts green with purple at tip; corolla puberulous and glandular punctate, upper lip 2-lobed, lobes obtuse, 1.5 mm long, 1.2 mm wide *P. ossolaea*
 11. Bracts green; corolla rather sparingly pubescent with minute spreading hairs (hirtellous), upper lip emarginate, lobes 1 mm long, 0.5 mm wide *P. coccinea*

Pachystachys lutea Nees, DC. Prodr.
11:320. 1847

Justicia lutea Ruiz & Pavon ex Schult. Mantissa 1. 146. 1822, nom. nud. *Pachystachys albiflora* Rizzini, Bol. Mus. Nac. Rio de Janeiro 8: 24, pl. 7. 1947.

Erect, lax shrub 1.5–2.5 m tall; stem slender, subterete, brownish, glabrous, the nodes more or less tumid; leaf blades sessile, oblong-lanceolate, 8.5–18 cm long and 2–5 cm wide, acuminate at apex, gradually narrowed from below middle to a rounded,

clasping base, 1 cm wide in larger leaves, entire or undulate, membranous, glabrous except for puberulent midrib, cystoliths numerous and prominent both above and below; inflorescence consisting of terminal, solitary spike 6–10 cm long, rachis densely puberulous; bracts densely imbricate, bright yellow or orange-yellow, ovate, 1.5–2 cm long, 1–1.5 cm wide (terminal bracts somewhat smaller, basal ones larger), short-acuminate at apex, subcordate at base, glandular-pilose, especially so along upper margins; bractlets lanceolate-spatulate to elliptic, 9–12 mm long, 3.5–4 mm wide, acuminate, glandular-pilose along margins; calyx campanulate, 9–10 mm long, segments linear-lanceolate, 7–9 mm long and 1–1.1 mm wide near base, sparingly puberulous and ciliate; corolla white, 5.5 cm long, tube curved, 3 mm wide at base, narrowed to 1.75 mm at 5 mm above base, thence gradually enlarged to 8.5 mm at throat, pilose and glandular-punctate, upper lip erect, lanceolate, 1.8 cm long, 5–5.5 mm wide near base, gradually narrowed to 1 mm at tip, sparingly pilose, minutely 2-lobed, lobes obtuse, lower lip ovate, undulate, sparingly pilose, 3-lobed, lateral lobes 3.5 mm long, 2 mm wide, obtuse or rounded, middle lobe 3.5 mm long, 2.5 mm wide, obtuse or rounded; stamens attached near base of corolla tube, filaments 5 cm long, sparingly puberulous, anthers bright green, 5 mm long, deeply sagittate, basal lobes muticous; pollen grains 53 μ m long, 45 μ m wide, tricolporate, each colpus flanked by 2 pseudocolpi, tectum almost complete, psilate-punctate (Fig. 1); staminodes none; ovary glabrous; capsule clavate, 13 mm long, 5 mm broad, 2.75 mm thick, glabrous; retinacula 2 mm long, slightly curved, tip flattened, obtuse; seeds 2, brownish, cordate, flattened, about 4.5 mm long and 4 mm broad, glabrous.

Material.—PERU: San Martín: Lamas, *Matthews 1538* (syntype K); On trail from Lamas to San Antonio E of Río Chupiseña, *Belshaw 3500* (NY, UC, US); Pongo de Cainarachi, Río Cainarachi, 230 m, *Klug*

2655 (NY, US); Juanjui, 400 m, *Klug 3838* (NY, US); Prov. Mariscal Cáceres: Dtto. Tocache Nuevo: Quebrada de Huaquisha, 500–600 m, *Plowman, Schunke & Rury 11389* (F, US); Quebrada de Cañuto, ca. 500 m, *Schunke-Vigo 12083* (NY, US); Quebrada de Saule Chico, *Schunke-Vigo 4346* (F, NY, US); Between Uchiza and Puerto Huicte, 500–600 m, *Ferreya 4410* (US, USM); Fundo Melódia, road to Shunté, 800 m, *Schunke-Vigo 7436* (US); Huánuco: Chicolaya, *Tafalla 345* (syntype G, MA); Prov. Tingo María: Vicinity of Tingo María, 650–700 m, *Ferreya 6772* (US, USM); 625–1100 m, *Allard 21622* (US); Junín: Near La Merced, *Soukup 2531* (US); Cuzco: Prov. La Convención: Hda. Luisiana, 620 m, *Dudley 11525* (NA). BRAZIL: Acre: Varadouro S. Luiz, *Kuhlmann 728* (R, holotype of *P. albiflora* Rizz.).

At edge of ravines in dense forests, sometimes saxatile on very steep dry cliffs, usually found on banks of streams at elevations between 230 and 1100 meters. This native of Peru is often found in cultivation in greenhouses.

Pachystachys longibracteata Wasshausen,
sp. nov.

Figs. 1, 2

Suffrutex; caules subquadrangulares, glabri; lamina foliorum elliptica, acuminata, basi angustata in petiolum amplexans, glabra; spicae solitariae, terminales, rhachidi puberula; bracteae grandes, viridae, elliptica-ovatae, 15–17 mm latae, apice acuminatae vel obtusae; bracteolae linearilanceolatae; calycis segmenta anguste triangularia; corolla coccinea vel scarlatina, puberula, labio inferiore oblongo, lobo medio conduplicato apice curvato, lobis lateralibus leviter rotundatis.

Shrub 1–3 m high; stems subquadrangular, glabrous; leaf blades elliptic, to 35 cm long and 13 mm wide, acuminate at apex, narrowed from about middle to rounded, clasping base 2–3 cm wide in larger leaves,

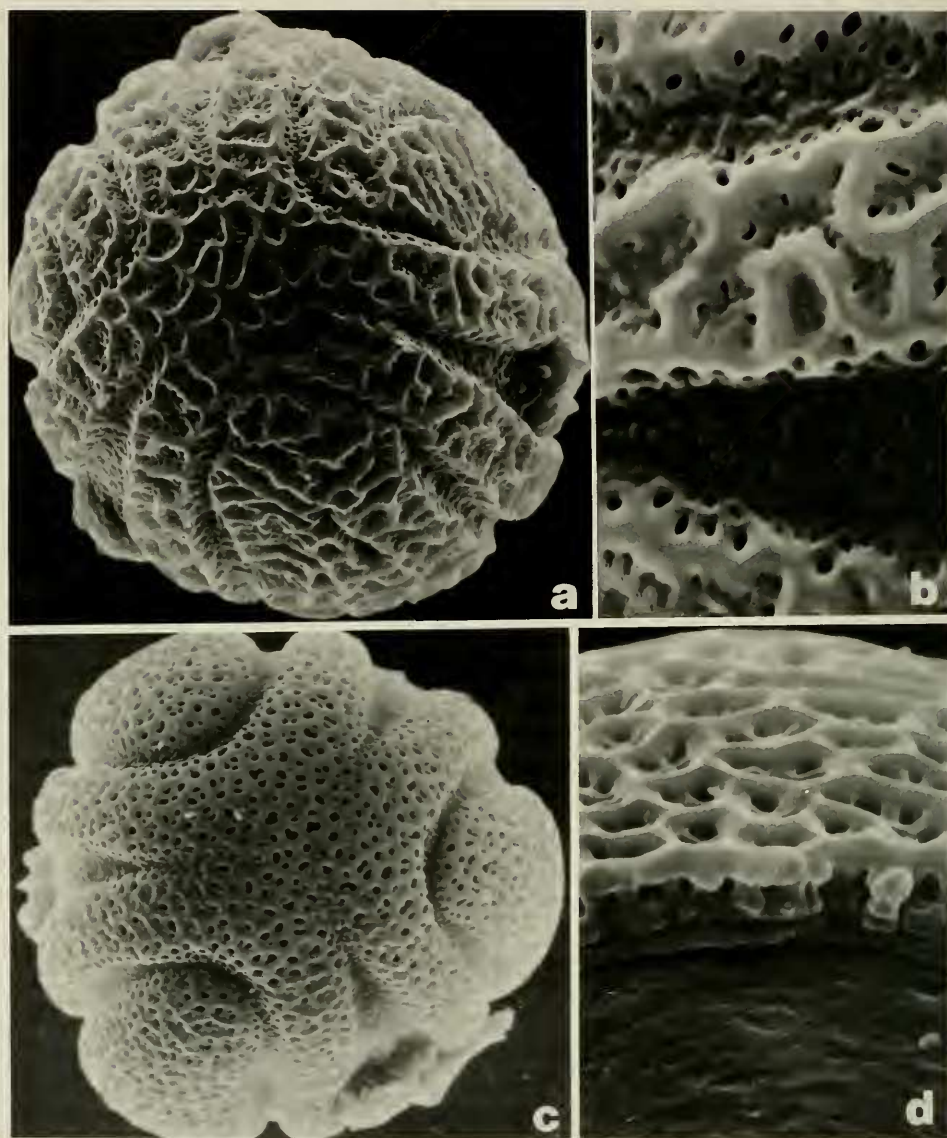


Fig. 1. SEM photomicrographs of *Pachystachys* pollen. A-B, *Pachystachys lutea* (Mennega 71-136); C-D, *Pachystachys longibracteata* (Killip & Smith 28725). A, Polar orientation, $\times 1800$; B, Portion of surface, including colpus at $\times 4600$; C, Polar orientation, $\times 1700$; D, Surface view of reticulate form of fractured grain, $\times 6600$.

entire or undulate, glabrous, cystoliths numerous, about 0.25 mm long; petioles to 7 cm long, glabrous; inflorescence to 23 cm long, internodes, bracts, calyx, and ovary densely but minutely puberulent; bracts

17 mm wide, acuminate to obtuse at apex, narrowed at base to short winged petiole; bractlets linear-lanceolate, to 17 mm long and 3 mm wide; calyx 2-3 mm long, segments narrowly triangular; corolla scarlet, sparingly and minutely puberulent, 6 cm



Fig. 2. A-E, *Pachystachys longibracteata* (Killip & Smith 27866). A, Flowering spike; B, Leaf blade; C, Bract and calyx; D, Corolla and exserted stamens and style; E, Corolla expanded, showing attachment of filaments.

long, 3 mm broad at base, narrowed to 2 mm at 5 mm above base, and then gradually narrowed to 8 mm at throat, lobes minutely ciliate, those of lower lip oblong, about 13

mm long, 6 mm broad, two lateral rounded at top, middle conduplicate and curved at tip, upper lip 2 cm long, 4 mm at base, gradually narrowed to small, bilobed tip

about 1 mm broad; filaments glabrous, anthers about 4 mm long; pollen grains $58\ \mu\text{m}$ long, $40\ \mu\text{m}$ wide, tricolporate, each mesocolpium flanked by two colpoid streaks, membrane densely granular, sexine suprareticulate, reticulation heterobrochate (Fig. 1); style glabrous, persistent after fall of corolla; capsule wanting.

Type.—PERU: Loreto: Puerto Arturo, lower Río Huallaga below Yurimaguas, ca. 135 m, *Killip & Smith 27866* (holotype US; isotype NY).

Additional specimens.—PERU: Loreto: Santa Rosa, lower Río Huallaga below Yurimaguas, ca. 135 m, *Killip & Smith 28725* (NY, US); Yurimaguas, lower Río Huallaga, ca. 135 m, *Killip & Smith 28055* (US); Shitari, near Isla Santa María, Yurimaguas, 150–180 m, *Ferreira 10159* (US, USM).

Occasional in dense forest at elevations of 135–180 meters.

This species is well marked and distinguished by its densely puberulous inflorescence and large leaf blades with their bases clasping the petiole and the unusually broad or short lobes of the lower lip of the corolla.

Pachystachys schunkei Wasshausen,

sp. nov.

Fig. 3

Suffrutex; caules subquadrangulares, brunoli, puberuli; lamina foliorum oblata vel ovata, acuminata, basi angustata in petiolum amplexans, glabra; spicae terminales, bifurcatae, aliquanto breves, rachidi dense puberula; bracteae viridae, oblanceolatae, acuminatae et minute mucronatae; bracteolae linear aristatae; calycis segmenta lanceolata, puberula, ciliolata; corolla coccinea, glabra, tubo leviter curvato, labio superiore recurvato bilobato, labio inferiore 3-lobato, lobis obovatis, lobo medio conduplicato.

Shrub 2–3 m tall; stem subquadrangular, brownish, puberulous; leaf blades oblong to ovate, 19–22 cm long and 8–8.5 cm wide, acuminate at apex, gradually narrowed from

below middle to a rounded, clasping base 1.5 cm wide in larger leaves, entire or undulate, thin, glabrous, shining, cystoliths inconspicuous; petioles 3–8.5 cm long, glabrous; inflorescence consisting of terminal, bifurcate spike 6–10 cm long, rachis densely puberulous; bracts green, oblanceolate, 3.5–4 cm long, 7–8 mm wide, acuminate, terminated by mucro about 1 mm long, gradually narrowed at base and attenuate, densely glandular pilose without, minute eglandular hairs intermixed with glandular ones, principal veins not prominent; bractlets linear-aristate, about 2 cm long, 1 mm wide, pubescence similar to that of bracts; calyx campanulate, 4.5 mm long, segments lanceolate, 4 mm long and 1 mm wide near base, acuminate, densely puberulous and ciliate; corolla vivid red, 5–5.5 cm long, tube slightly curved, 4 mm wide at base, narrowed to 2 mm at 5 mm above base, thence gradually enlarged to 6.5 mm at throat, glabrous, upper lip recurved, oblong to narrowly lanceolate, 1.4 cm long, 2.5 mm wide just below middle, gradually narrowed to 1.5 mm at tip, minutely 2-lobed, lobes obtuse, lower lip 3-lobed, lobes spreading, obovate, rounded at tip, lateral pair 13 mm long, 6 mm wide, middle lobe 9 mm long and 4.5 mm wide, conduplicate; stamens attached near middle of corolla tube, filaments 3 cm long, sparingly and inconspicuously puberulous, anthers 4 mm long, deeply sagittate, basal lobes muticous; staminodes none; ovary puberulous; capsule wanting.

Type.—PERU: San Martín: Prov. Mariscal Cáceres: Dto. Tocache Nuevo, Quebrada de Santa Rosa de Cachiyacu, 500–700 m, *Schunke-Vigo 7597* (Holotype US).

Occasional in tall forest.

Discussion.—*Pachystachys schunkei* is perhaps nearest in relationship to *P. fosteri*, another new species from Peru, but differs markedly in that the latter species has leaf blades elliptic to oblong, 11–14.5 cm wide, spikes 19–20 cm long, and prominently veined bracts 6–7 mm wide, not terminated



Fig. 3. A–D, *Pachystachys schunkei* (Schunke-Vigo 7597); E–I, *Pachystachys badiospica* (Schunke-Vigo 2714). A, Habit; B, Bract, bractlets and calyx; C, Corolla and exserted stamens and style; D, Corolla expanded, showing attachment of filaments; E, Habit; F, Bract and bractlets; G, Calyx; H, Corolla closed; I, Corolla expanded, showing attachment of filaments.

by a mucro. In contrast, *H. schunkei* has leaf blades oblong to ovate, 8–8.5 cm wide, spikes 6–10 cm long, and bracts not prominently veined, 7–8 mm wide, terminated by a mucro about 1 mm long.

Pachystachys fosteri Wasshausen, sp. nov.

Fig. 4

Suffrutex; caules subquadrangulares, brunneoli, glabri; lamina foliorum elliptica vel oblonga, acuminata, basi angustata in petiolum amplexans, glabra; spicae terminales, bifurcatae, 19–20 cm longae, rachidi dense puberula; bractae viridae, oblanceolatae, acuminatae, glanduloso-puberulae, venis 3 principalibus prominentibus; bracteolae lineares, puberulae; calycis segmenta lanceolata, puberula; corolla scarlatina, puberula, labio superiore erecto et recurvato bilobato, labio inferiore trilobato, lobis obovatis, lobo medio conduplicato et retuso.

Shrub 2–3 m tall; stem subquadrangular, brownish, glabrous; leaf blades elliptic to oblong, 33 cm long and 11–14.5 cm wide, acuminate at apex, gradually narrowed from below middle to a rounded, clasping base 2 cm wide in larger leaves, entire or undulate, glabrous, cystoliths numerous, especially below; petioles 3–9 cm long, glabrous; inflorescence terminal, consisting of bifurcate spike 19–20 cm long, rachis densely puberulous; bracts green, oblanceolate, 3.3 cm long, 6–7 mm wide, acuminate at apex, gradually narrowed at base and attenuate, densely glandular puberulous without, ciliate, three principal veins prominent; bractlets linear, 2.3 cm long, 1 mm wide, densely glandular-puberulous and ciliate; calyx campanulate, 6 mm long, segments lanceolate, 4.5 mm long and 1 mm wide near base, acuminate, densely puberulous and ciliate; corolla scarlet, 5 cm long, tube slightly curved, 3–3.5 mm wide at base, narrowed to 2 mm at 4 mm above base, thence gradually enlarged to 8 mm at throat, puberulous and occasionally interspersed with mi-

nute glands, upper lip erect and recurved, oblong to narrowly lanceolate, 1.2 cm long, 2.5 mm wide just below middle, gradually narrowed to 1.5 mm at tip, minutely 2-lobed, lobes obtuse, lower lip 3-lobed, lobes spreading, obovate, lateral pair 12 mm long, 5 mm wide, rounded at tip, middle lobe 9 mm long and 6–6.5 mm wide, conduplicate and retuse at tip; stamens attached near middle of corolla tube, filaments 3.5 cm long, sparingly puberulous, anthers 4.7 mm long, deeply sagittate, basal lobes mucicous; staminodes none; ovary densely tomentose; capsule wanting.

Type. — PERU: Huánuco: Pachitea; Puerto Inca, 2–5 km E of town, 250–300 m, Foster 8686 (holotype US).

Occasional, along forest trails.

Discussion. — Named in honor of the collector, Robin B. Foster, in recognition of his valuable contributions to our knowledge of Peruvian botany. The major differences between *Pachystachys fosteri* and *P. schunkei*, its nearest relative, are described under the discussion of the latter species.

Pachystachys badiospica Wasshausen,
sp. nov.

Figs. 3, 5

Suffrutex; caules subquadrangulares, brunneoli, glabri; lamina foliorum elliptica vel ovata, acuminata, basi angustata in petiolum amplexans, glabra; spicae terminales, solitariae vel bifurcatae, rachidi dense puberula; bractae badiae lanceolatae, mucronulatae, extus dense glanduloso-pilosa; bracteolae lanceolatae; calycis segmenta subaequalia, lanceolata, parce glanduloso-pilosa; corolla coccinea, parce pilosa, tubo leviter curvato, labio superiore erecto, bilobato, labio inferiore trilobato, lobis lateralibus oblongis, obtusis, lobo medio retuso; antherae rubrae.

Shrub 1–2 m tall; stem subquadrangular, brownish, glabrous; leaf blades petiolate, elliptic to ovate, 15–26 cm long and 5.5–11.5 cm wide, acuminate at apex, narrowed from



Fig. 4. A-E, *Pachystachys fosteri* (Foster 8686); F-I, *Pachystachys rosea* (Vargas C, 23159). A, Habit; B, Bract and bractlets; C, Calyx; D, Corolla and exserted stamens and style; E, Corolla expanded, showing attachment of filaments; F, Habit; G, Bractlets and calyx; H, Corolla and exserted stamens and style; I, Corolla expanded, showing attachment of filaments.

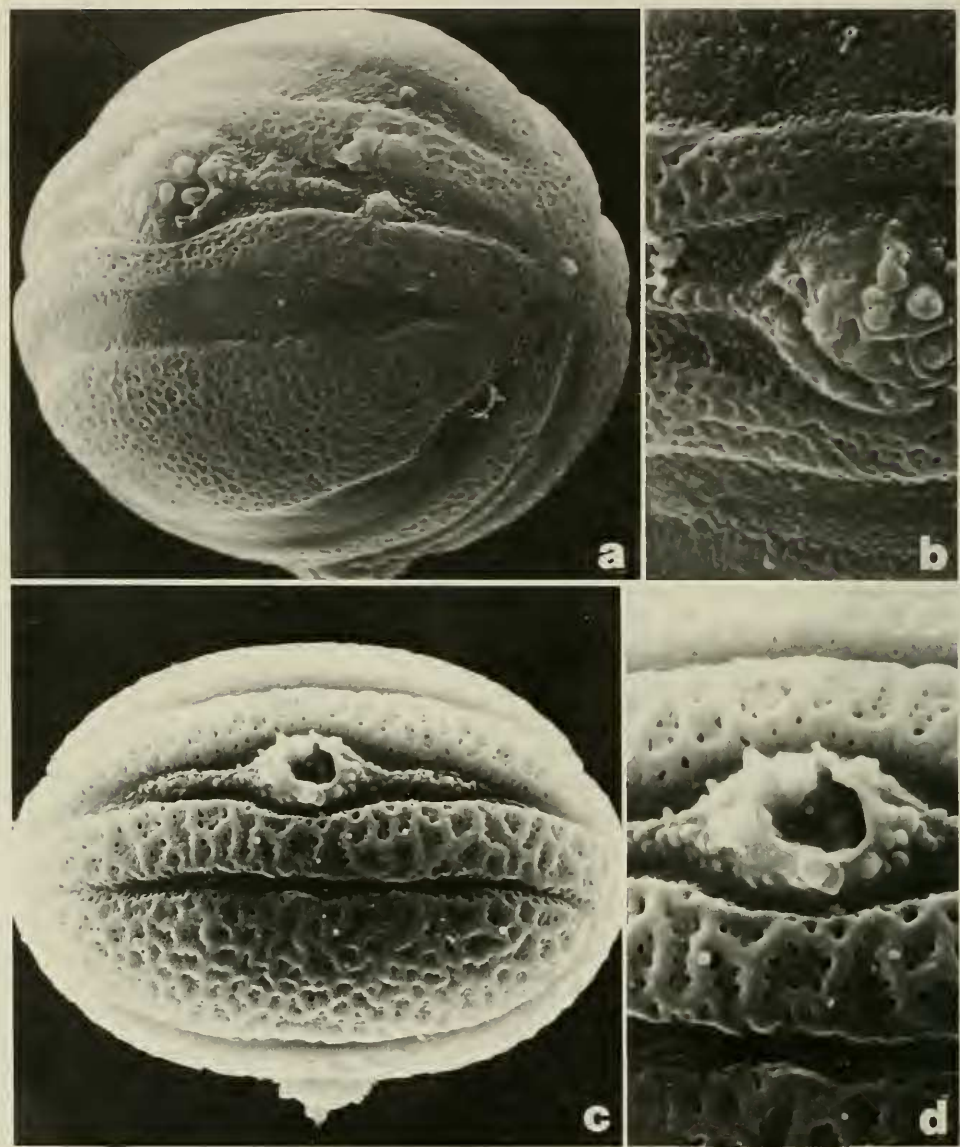


Fig. 5. SEM photomicrographs of *Pachystachys* pollen. A–B, *Pachystachys badiospica* (Schunke-Vigo 2714); C–D, *Pachystachys incarnata* (Killip & Smith 28926). A, Equatorial view, $\times 1700$; B, Portion of surface, including pore at $\times 3000$; C, Equatorial view, $\times 2000$; D, Portion of surface, including pore at 3700.

below middle to rounded, clasping base 15 mm wide in larger leaves, moderately firm, entire or undulate, upper surface dark-green, nitid, lower surface paler green, glabrous, cystoliths numerous and conspicuous both above and below; petioles 2–6 cm long, can-

aliculate, glabrous; inflorescence consisting of solitary or bifurcate, terminal spike 10–16 cm long, rachis densely glandular puberulous; bracts brownish-red, lanceolate, 8 mm long, 1.5 mm wide, mucronulate at apex, densely glandular-pilose without, mi-

nute eglandular hairs intermixed with glandular ones; bractlets lanceolate, 6.5 mm long, 1.25 mm wide, pubescence similar to that of bracts; calyx deeply 5-parted, 15 mm long, segments lanceolate, subequal, sparingly glandular-pilose, posterior segment 9 mm long, 1 mm wide, anterior pair 13 mm long, 1.5 mm wide, lateral pair 12 mm long, 1.25 mm wide; corolla red, 5 cm long, sparingly pilose, tube slightly curved, 5 mm wide at base, narrowed to 3 mm at 5 mm above base, thence gradually enlarged to 18 mm at throat, upper lip erect, oblong to narrowly lanceolate, 1.5 cm long, 4 mm wide, minutely 2-lobed, lobes obtuse, lower lip ovate, 1 cm long, 3-lobed, lateral lobes oblong, 7 mm long, 3 mm wide, obtuse or rounded, middle lobe 8 mm long, 6 mm wide, retuse; stamens attached near base of corolla tube, filaments 2.7 cm long, sparingly puberulous, anthers red, 4.5 mm long, deeply sagittate, basal lobes muticous, pollen grains 50 μ m long, 41 μ m wide, tricolporate, each mesocolpium with two colpoid streaks, tectum almost complete, psilate-punctate (Fig. 5); staminodes none; ovary glabrous; capsule clavate, long-stipitate, 2 cm long, puberulous, 2-seeded, solid basal portion about 1 cm long, seed-bearing cavity 8 mm broad, seeds flattened, orbicular, 7 mm long and broad, muricate, retinacula 3 mm long, slightly curved, tip flattened, obtuse.

Type.—PERU: JUNÍN: Satipo, *Ridoutt s.n.* (holotype US; isotype USM).

Additional specimens.—PERU: Loreto: Prov. Coronel Portillo, Dtto. Iparia, Bosque Nacional de Iparia, along Río Ucayali in the vicinity of Iparia, 300 m, *Schunke V. 2714* (US). JUNÍN: road between Santa Clara and Satipo, *Ridoutt s.n.* (US, USM).

In openings and along the edge of dense, humid forests.

Discussion.—This species is readily distinguished by its narrow, brownish-red, lanceolate, glandular-pilose bracts, bractlets, and calyx segments. It is not very closely allied to any of the known species of *Pachystachys*.

Pachystachys incarnata Wasshausen,
sp. nov.

Figs. 5, 6

Frutex, caules erecti, teretes, brunneoli, glabri; lamina foliorum elliptica vel ovata, acuminata, basi angustata in petiolum amplectens, membranacea, nitida, glabra; spicae terminales, rachidi dense puberula; bractae dense imbricatae, stramineae, ovatae, mucronulatae, parce glanduloso-pilosae; bracteolae lineari-lanceolatae, puberulae; calyx campanulatus, segmenta lanceolata, puberula; corolla rosea, puberula, tubo leviter curvato, labio superiore erecto, bilobato, labio inferiore trilobato, lobis patulis, lobis lateralibus oblongis vel anguste ovatis, rotundatis, lobo medio obovato, conduplicato et retuso.

Erect shrub about 2 m tall; stem terete, brownish, glabrous; leaf blades elliptic to ovate, 20–25 cm long and 7.5–8.2 cm wide, acuminate at apex, gradually narrowed from below middle to a rounded, clasping base 1 cm wide in larger leaves, entire or undulate, membranous, nitid and dark-green above, much lighter-green below, glabrous, cystoliths numerous and prominent both above and below; petioles 2–3 cm long, minutely puberulous; inflorescence consisting of terminal, solitary spike 13 cm long, rachis densely puberulous; bracts densely imbricate, yellowish-green, ovate, 2 cm long, 1.4 cm wide, mucronulate at apex, gradually narrowed and cuneate at base, sparingly glandular-pilose, especially near apex; bractlets linear-lanceolate, 11 mm long, 1.25 mm wide, puberulous and ciliate, bearing few glandular trichomes near apex; calyx campanulate, 12 mm long, segments lanceolate, 10 mm long and 1 mm wide near base, acuminate, puberulous and ciliate; corolla pink, 4 cm long, puberulous, tube slightly curved, 4 mm wide at base, narrowed to 1.8 mm at 5 mm above base, thence gradually enlarged to 6.5 mm at throat, upper lip erect, oblong to narrowly lanceolate, 1.2 cm long, 3.5–4 mm wide near base,



Fig. 6. A-D, *Pachystachys incarnata* (Killip & Smith 28926); E-G, *Pachystachys killipii* (Killip & Smith 2661). A, Habit; B, Bractlets and calyx; C, Corolla and exserted stamens; D, Corolla expanded, showing attachment of filaments; E, Habit; F, Bractlets and calyx; G, Corolla and exserted stamens and style.

gradually narrowed to 1 mm at tip, minutely 2-lobed, lobes obtuse, lower lip 3-lobed, lobes spreading, lateral pair oblong to narrowly ovate, 15 mm long, 5 mm wide, rounded at tip, middle lobe obovate, 12 mm long and 4.5 mm wide, conduplicate and retuse, minutely lobulate on one side; stamens attached near base of corolla tube, filaments 4 cm long, minutely puberulous, anthers 5 mm long, deeply sagittate, basal lobes muticous; pollen grains 46 μ m long, 28 μ m wide, tricolporate, each mesocolpium with two colpoid streaks, tectum almost complete, psilate-punctate (Fig. 5); staminodes none; ovary puberulous; capsule wanting.

Type.—PERU: Loreto: Santa Rosa, lower Río Huallaga below Yurimaguas, ca. 135 m, Killip & Smith 28926 (holotype US; isotype NY).

Occasional in dense forest.

Discussion.—*Pachystachys incarnata* superficially resembles *P. lutea* Nees. However, in *P. lutea*, the corolla is white, 5.5 cm long, the bracts bright yellow or orange-yellow, and the leaf blades are oblong-lanceolate, 8.5–18 cm long and 2–5 cm wide. In *P. incarnata*, the corolla is pink, only 4 cm long, the bracts yellowish-green, and the leaf blades are elliptic to ovate, 20–25 cm long and 7.5–8.2 cm wide.

Pachystachys puberula Wasshausen,
sp. nov.
Figs. 7, 8

Suffrutex; caules subquadrangulares, brunnei, glabri; lamina foliorum oblonga vel ovata, breviter acuminata, basi angustata in petiolo amplexans, atrovirens et nitida, glabra; spicae terminales, solitariae, rachidi subtiliter puberula; bractae laxae imbricatae, atrovirens, late ovatae, obtusae et apiculatae, basi angustatae ad petiolos brevialatae; calyx campanulatus, segmenta anguste triangularia, dense puberula; corolla carminea, puberula, tubo leviter curvato, labio superiore erecto et recurvato, bilo-

bato, labio inferiore trilobato, lobis obovatis, patulis, lobo medio conduplicato apice obtuso.

Shrub 2–5 m tall; stem subquadrangular, dark-brown, glabrous; leaf blades very dark-green and glossy, oblong to ovate, 15–28 cm long and 7.5–13.5 cm wide, short-acuminate at apex, gradually narrowed from below middle to a rounded, clasping base 1 cm wide in larger leaves, entire or undulate, glabrous, cystoliths numerous, especially below; petioles 3–8 cm long; inflorescence consisting of solitary, terminal spike 7–15 cm or more long, rachis finely puberulous; bracts rather loosely imbricate, dark-green, broadly ovate, 1.5–2.5 cm long, 10–18 mm broad (terminal bracts somewhat smaller, basal ones larger), rounded and apiculate at apex, narrowed at base to short-winged petiole, densely puberulous; bractlets lanceolate, about 4 mm long and 1.2 mm broad, densely puberulous; calyx campanulate, 3.5 mm long, segments narrowly triangular, about 2 mm long and 1 mm wide at base, acuminate, densely puberulous; corolla crimson, 3.5–4 cm long, tube slightly curved, 3.5–4 mm wide at base, narrowed to 2 mm at 7 mm above base, thence gradually enlarged to 7 mm at throat, puberulous, upper lip erect and recurved, lanceolate, 1.5 cm long, 3.5 mm wide near base, gradually narrowed to 1 mm at tip, minutely 2-lobed, lobes obtuse, lower lip 3-lobed, spreading, lobes obovate, rounded at tip, lateral ones 12 mm long, 6 mm broad, middle lobe 15 mm long and 5.5 mm broad, conduplicate, obtuse at tip; stamens attached near base of the corolla tube, filaments 3.5–4.3 cm long, glabrous, anthers 3.8–4 mm long, deeply sagittate, basal lobes muticous; pollen grains 52 μ m long, 35 μ m wide, tricolporate, each mesocolpium flanked with two colpoid streaks, tectum almost complete, psilate-punctate (Fig. 8); staminodes none; ovary puberulous; capsule wanting.

Type.—PERU: San Martín: Prov. Marítin: Puente Colombia, 24 km S of Tarapoto,



Fig. 7. A–D, *Pachystachys puberula* (Wasshausen & Encarnación 1023). A, Habit; B, Calyx; C, Corolla and exserted stamens and style; D, Corolla showing attachment of filaments.

350–550 m, Wasshausen & Encarnación 1023 (holotype US, isotypes USM, US-2).

Additional specimens.—PERU: San Martín: Prov. Lamas: trail San José de Sisa-

Agua Blanca, 380–400 m, Ferreyra 7946 (US, USM); between Agua Blanca and Desquito, 600–800 m, Ferreyra 7963 (US, USM); Prov. San Martín: Tarapoto, 830 m,

Woytkowski 35110 (US); Juan-Guerra, Tarapoto, *Ule 6489* (G, K); near Tarapoto, *Spruce 3974* (K); Pucayacu, 11 km S of Tarapoto, 200–250 m, *Ferreyra 7730* (US, USM); Granja El Porvenir, 25 km S of Tarapoto, 400–500 m *Ferreyra 17855* (US, USM); Pucacaca, *Plowman 6016A* (GH, US); Dtto. Shapaja: Shapaja, 264 m, *Schunke-Vigo 9815* (MO); 1–4 km S of Shapaja, ca. 300 m, *Belshaw 3133* (UC, US); Puente Colombia, 200–250 m, *Ferreyra 17545* (US, USM); Prov. Huallaga: between Bellavista and Baños, 200–300 m, *Ferreyra 4731* (US, USM); between Juanjui and Tingo de Saposoa, 200–300 m, *Ferreyra 4793* (US, USM); near Bellavista, 250–300 m, *Ferreyra 10099* (US, USM); Prov. Mariscal Cáceres: vicinity of Juanjui, 300–400 m, *Ferreyra 4498* (US, USM); *4538a* (US, USM).

Distributed in open places and along margins of trails in lowland rainforest.

Discussion. — *Pachystachys puberula* is distinguished from *P. spicata* in that the corollas of the former species are 3.5–4 cm long, the upper corolla lip is recurved and 3.5 mm broad near base, the lower corolla lip lobes are obovate with the lateral ones 12 mm long and 6 mm broad and the bracts are broadly ovate, 10–18 mm broad, narrowed and apiculate at apex. In *P. spicata* the corollas are 5–7 cm long, the upper corolla lip is erect and 6.5 mm broad near base, the lower corolla lip lobes are linear with the lateral ones 17–24 mm long and 4 mm broad and the bracts are ovate-lanceolate, 7–11 mm broad, acuminate at apex.

Pachystachys spicata (R.&P.) Wasshausen, comb. nov.

Justicia spicata Ruiz & Pavón, Fl. Peruv. & Chil. Prodr. 1:8. pl. 9. 1798. *Pachystachys riedeliana* Nees in Mart. Fl. Bras. 9:99. 1847. *P. latior* Nees in DC. Prodr. 11:320. 1847. *P. asperula* Nees in DC. Prodr. 11:320. 1847.

Suffrutescent, erect, simple or sparingly branched plant 1–5 m tall; stem glabrous, terete or with upper portions subquadran-gular; leaves petioled, blades oblong, elliptic or broadly oblanceolate, 15–27 cm long and 7–11 cm wide, acute to acuminate, tip itself usually blunt, gradually to rather abruptly narrowed at base, glabrous, firm, margins entire, costa and lateral veins (9–12 pairs) rather prominent; petioles 2.5–7 cm long, glabrous; spikes solitary, terminal, 12–22 cm long, rachis finely puberulous; bracts imbricate, green, ovate-lanceolate, 1.5–2.5 cm long, 7–11 mm broad, terminal bracts somewhat smaller, basal ones larger, acuminate, narrowed at base, short-petiolate, both surfaces puberulous, lower surface more densely so, bearing additional glandular hairs; bractlets narrowly linear, about 3 mm long and 0.5 mm broad, sparingly puberulous; calyx campanulate, 4.5 mm long, segments narrowly triangular, about 3 mm long and 1 mm wide at base, acuminate, sparingly hirtellous; corolla scarlet, becoming orange-red with age, 5.5–7 cm long, glabrous to sparingly hirtellous, tube curved, 4 mm wide at base, gradually enlarged to 8 mm at throat, upper lip erect, lanceolate, 6.5 mm broad near base, gradually narrowed to 1.5 mm at tip, 2-lobed, lobes obtuse, 1 mm long and wide, lower lip 3-lobed, lobes spreading, linear, rounded at tip, middle lobe 17 mm long and 3 mm broad, lateral ones 17–24 mm long and 4 mm broad; stamens attached near base of corolla tube, filaments yellow, about 5 cm long, puberulous, anthers yellow, 7 mm long, deeply sagittate, basal lobes muticous; pollen grains 61 μ m long, 35 μ m wide, tricolporate, each mesocolpium with two colpoid streaks, membrane densely granular, sexine supra-reticulate, reticulation heterobrochate (Fig. 8); staminodes rudimentary, puberulous; ovary glabrous; capsule clavate, 16 mm long, 5 mm broad, 4.5 mm thick, glabrous; retinacula 3 mm long, slightly curved, tips flattened, obtuse; seeds 4, brownish, cordate,

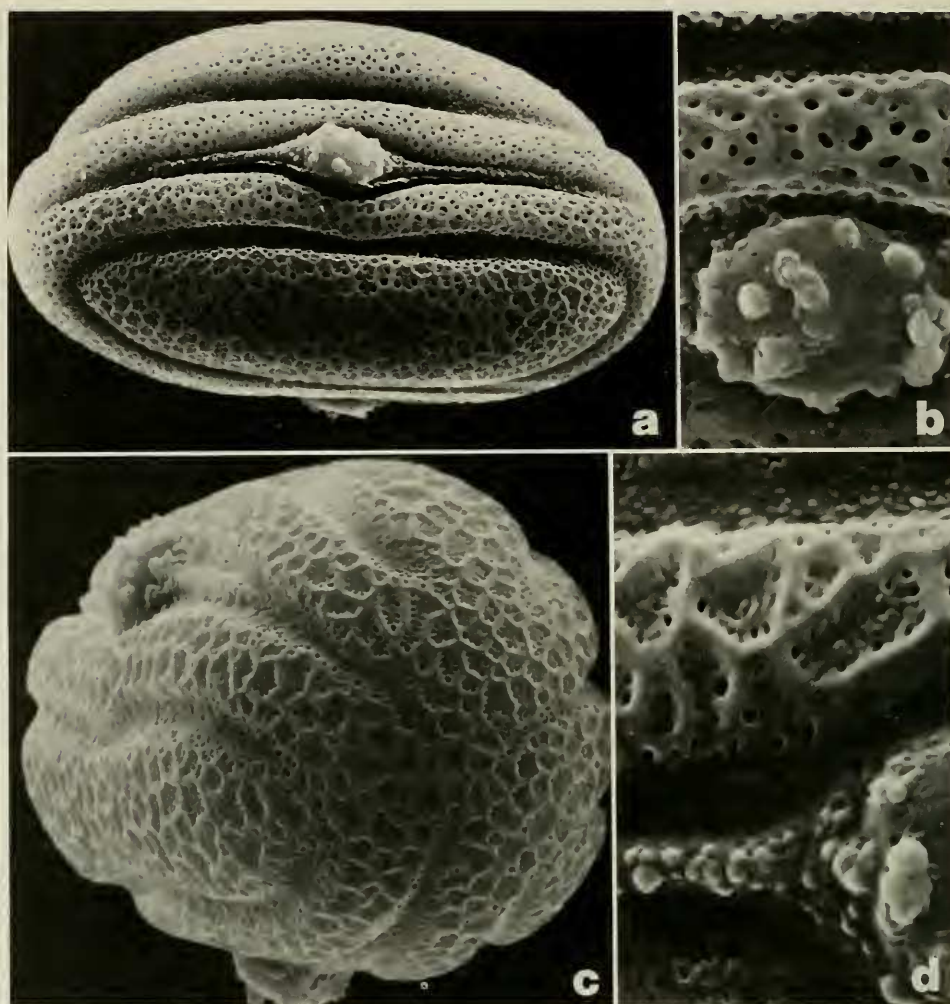


Fig. 8. SEM photomicrographs of *Pachystachys* pollen. A–B, *Pachystachys puberula* (Wasshausen & Encarnación 1023); C–D, *Pachystachys spicata* (Calderón 2826). A, Equatorial view, $\times 1400$; B, Portion of surface, including pore at $\times 4000$; C, Polar orientation, $\times 1800$; D, Portion of surface, including pore at 4400.

flattened, 5.5 mm long, 4 mm wide, glabrous, muricate.

Material. — CUBA: Oriente: Monte Verde, *León* 3832 (NY); Santiago, banks of Cañas River, El Cobre, *Clemente* 5885 (NY, US); Sierra Maestra, Finca la Philanthropia, *Ekman* 15697 (NY, S, US); Sierra Maestra, Loma del Gato, banks of Cañas River, *Clement* 562 (NY), La Perla to Santa Ana, 660 m, *Shafer* 8592 (NY, US). JAMAICA: Westmoreland: Bluefields Mountains, 650

m, *Britton & Hollick* 1975 (NY). Manchester: Mandville, *Smith s.n.* (US). Clarendon: 1 m NW of Rock River, 165–230 m, *Proctor* 32842 (NY). St. Catherine: Bog Walk, *Crawford* 814 (NY). St. Mary: Castleton district, 150 m, *Harris* 11933 (NY, US); Metcalf district, Constant Spring to Annatto Bay, *Britton* 825 (NY). St. Andrew: Manning Hill, 380 m, *Powell* 778 (NY, US); Stoney Hill, *Smith s.n.* (US). Portland: vicinity of Mill Bank, 200–300 m, *Maxon &*

Killip 202 (US); vicinity of Windsor, 150–175 m, *Maxon & Killip* 271 (NY, US); Blue Hole, *Fosberg* 59422 (US); near Long Bay, 15 m, *Gentry* 28287 (MO, NY). Without exact locality: *Fredholm* 3229 (US). LESSER ANTILLES: Guadeloupe: Sainte Rose, *Quentin* 1936 (P, US); Trois-Rivieres, *Stehlé* 1855 (US). Dominica: Carib Reserve, *Hodge* 3307 (US); Geneva, *Nicolson* 2172 (US); between Fond Baron Estate and Pichelin, *Ernst* 1591 (US); Lisdara, *Hodge* 2326 (GH, NY); road to Morne Plat Pays, *Gillis* 8118 (FTG, US); Portsmouth, *Hodge* 847 (NY, US); Salybia, *Hodge* 846 (GH); along Stewart's River near its mouth on Grand Bay, *Eggers* 641 (C), *Wilbur et al.* 8027 (US). Martinique: Balata to Trivoli, 250 m *Stehlé* 5742 (US); La Gracée, *Rodriguez* 3622 (US). St. Vincent: along Chateaubelair River, 300–400 m, *Morton* 5104 (US); 160 m, *Smith & Smith* 981 (NY). Grenada: Mt. Pleasant, 500 m, *Miller* 160 (US). TRINIDAD: Caura River Valley, *Britton & Hazen* 1203 (NY, US); E of Sangre Grande near Cunapi River, *Crosby* 4 (DUKE, US); edge of Aripo Savannah, *Howard* 10350 (NY, US); Arima Valley Road, North Range, 150–600 m, *Cowan & Simmonds* 1221 (US); 15.8 km above Arima, *Harriman* 17598 (OSH, US); Maracas waterfall, 160 m, *Kallov* B152 (NY). Without exact locality: *Lockhart s.n.* (K, holotype of *P. asperula* Nees); 1877–80, *Fendler* 534 (BM, NY); 1874, *Kuntze* 598 (NY, US); 1889, *Broadway* 3435 (US). GUYANA: Without exact locality: *Parker s.n.* (K, holotype of *P. latior* Nees). COLOMBIA: Meta: Río Duida, Mt. Macarena, 330 m, *Gilliard s.n.* (NY); Llanos Orientales, Villavicencio to Guayuriba, 600 m, *Garcia-Barriga* 18944 (AMES). El Valle: Las Juntas, on the Río Dagua, *Lehmann* 1887 (US); Cisneros, 300–500 m, *Killip* 35590 (US). ECUADOR: Esmeraldas: Río Santiago at Concepción, 30 m, *Holm-Nielsen et al.* 25976 (AAU). Manabí: Balao, *Eggers* 14135 (US); Olmedo, 100 m, *Haught* 3484 (NY, US). Guayas: 3 km E of Olon, 75–190 m, *Dodson & Thien* 1660 (US); 2–4 km E from Recinto Olon, *Gentry* 10045 (MO, US). Los Ríos: near Quevedo, Canton Vinces, ca. 50 m, *Mexia* 6609 (US). El Oro: between Santa Rosa and La Chorita, 0–100 m, *Hitchcock* 21116 (NY, US). Pichincha: Santo Domingo, 570 m, *Dodson & Thien* 1626 (US); Río Blanco below confluence with Río Toachi, 300 m, *Harling* 4490 (S, US); Patricio Pilar, 45 km S of Santo Domingo, 400 m, *Holm-Nielsen* 16017 (AAU). Chimborazo: base of Volcán Chimborazo, 900 m, *Spruce s.n.* (K). Pastaza: Shiguacocha, ca. 5 km E of Puerto Sarayacu, *Lugo* 3852 (GB, US). Without exact locality: *Pearce s.n.* (K); *Gilmartin* 367 (US). PERU: Amazonas: Prov. de Bagua: Río Marañón opposite Quebrada Miraná, 425–450 m, *Wurdack* 2010 (NY, US, USM). San Martín: Prov. Moyobamba: Moyobamba, *Mathews* 1537 (K). Prov. Lamas: along Río Mayo, *Spruce* 4872 (K); Lamas, 600–800 m, *Ferreyra* 17333 (US, USM); between Tabalosos and Lamas, ca. 500 m, *Belshaw* 3414 (K, NY, UC, US). Prov. Huallaga: Saposoa, 200–300 m, *Ferreyra* 4614 (US, USM); 350 m, *Sagastegui* 6837 (US). Prov. Mariscal Caceres: Juanjui, *Sandeman* 35 (K); Dtto. Tocache Nuevo: Quebrada Cachiyacu de Huaquisha, ca. 500–600 m, *Schunke-Vigo* 12515 (US); Quebrada de Saule Chico, *Schunke-Vigo* 4349 (NY, US); Fundo “Curare Land,” propiedad de José-Schunke V., 500–525 m, *Schunke-Vigo* 10951 (MO, US). Loreta: Prov. Maynas: San Antonio, on Río Itaya, ca. 110 m, *Killip & Smith* 29426 (NY, US); Soledad, on Río Itaya, ca. 110 m, *Killip & Smith* 29683 (NY, US); Caballococha, *Williams* 2367 (US); below mouth of Río Ucayali, 130 m, *Gentry et al.* 29999 (MO, US); Río Nanay, *Torres* 0224 (AMAZ, US). Prov. Alto Amazonas: Pumayacu, between Balsapuerto and Moyabamba, 600–1200 m, *Klug* 3219 (NY, US). Prov. Coronel Portillo: bank of Río Neshuya, km 61 on Federico Basache road, *Encarnación* 672 (US). Huánuco: Prov. Leoncio Prado: Dtto. Rupa Rupa: Tingo María, *Plowman* 7565 (US); *Asplund* 13218 (S); 600–700 m, *Ferreyra*

2278 (US, USM); 650 m, *Wasshausen & Tovar 1260* (US, USM); E of Tingo María, 700–800 m, *Schunke-Vigo 10518* (US). Junín: Prov. Tarma: La Merced, ca. 650 m, *Macbride 5565* (F, NY, US); Río Seco, 15 km from La Merced, *Soukup 2494* (US); Río Negro, 800 m, *Woytkowski 5814* (MO, US); Río Perené, Colonia Perené, 600 m, *Killip & Smith 25228* (US); Río Paucartambo Valley, near Perené Bridge, 700 m, *Killip & Smith 25380* (US). Ayacucho: Prov. La Mar: Hda. Luisiana, 640 m, *Wasshausen & Encarnación 639* (US, USM). Cuzco: Prov. La Convención: 3 km NE of Hda. Luisiana and Río Apurímac, 660 m, *Dudley 11450* (NA); 4 km E of San Francisco de Apurímac, 750 m, *Wasshausen & Encarnación 518* (US, USM). Prov. Paucartambo: Hda. Villa Carmen, 540 m, *Vargas 14701* (CUZ, US); Dtto. Cosñipata: 9 km N of Pilcopata, 600 m, *Wasshausen & Encarnación 580* (US, USM); Valley de Cosñipata, between Mitiana and Keros, ca. 800 m, *Scolnik 866* (NY). Prov. Quispicanchis: Marcapata Valley, 1200 m, *Herrera 1170* (US). Madre de Dios: Río Acre: Seringal Auristella, *Ule 9808b* (G, K). Without exact locality: *Ruiz & Pavon s.n.* (MA, holotype of *Justicia spicata* Ruiz & Pavon; F, photo); 1878, *Martinet s.n.* (P). BOLIVIA: Pando: W bank of Río Madeira, opposite Abuña, *Prance et al. 5695* (INPA, NY, US); 2 km above Ribeirão, *Prance 6499* (INPA, NY, US); Nicolas Suarez, ca. 30 km SW of Cobija on road to Naraúda, ca. 250 m, *Sperling & King 6607* (NY, US). El Beni: junction of Rivers Beni and Madre de Dios, *Rusby 1099* (NY, US). La Paz: Mapiri, *Bang 1555* (NY, US); 750 m, *Buchtien 1472* (US). Prov. S. Yungas: basin of Río Bopi, San Bartolome, 750–900 m, *Krukoff 10236* (NY, US); Bopi River Valley, 650 m, *White 646* (NY). Cochabamba: Prov. Chapare, Todos Santos, 300 m, *Steinbach 429* (NY, US). Without exact locality: *Pearce s.n.* (K). BRAZIL: Amazônas: Borba, *Riedel s.n.* (LE, holotype of *P. riedeliana* Nees; frag. GRZ); Parati, *Traill s.n.* (K); Río Acre, Seringal São Francisco, *Ule*

9898 (K); 9809 (K); Bôca do Acre, Ríos Purus & Acre, track from São Paulo to Terra Firme, Río Purus, opposite Bôca do Acre, *Prance et al. 2582* (INPA, NY); Manacapuru, *Spruce 1622* (K); Namorado Novo, watershed between Río Curuquetê and Río Madeira at Abuña, *Prance et al. 14677* (INPA, NY, US). Rondônia: Río Jamari-Cachoeira de Sta. Cruz, *Pires & Martin 9957* (UB, US); basin of Río Madeira, 4 km N of Mutuparaná, *Prance et al. 5470* (INPA, NY, US); S bank of Río Madeira, 2 km above Mutuparaná, *Prance et al. 5670* (INPA, NY, US); São Lourenço cassiterite mine, ca. 20 km NW of Río Madeira, across from Mutuparaná, *Calderón et al. 2826* (US). Acre-Amazônas: município de Boca do Acre, vicinity of Río Iaco, *Cid & Nelson 2730* (INPA, NY). Acre: near mouth of Río Macauhan (tributary of Río Yaco), *Krukoff 5376* (NY); 5547 (NY). Pará: 1908, *Bakar s.n.* (US); Tauá, *Spruce 266* (K); Pôrto do Igarapé Mururetena, S. Miguel do Guamá, *Black 56-18888* (INPA, US).

Edge of lowland rainforest, margins of thickets, along trails or river banks at elevations between 150 and 700 meters. West Indies southward to Bolivia and eastward to Amazonian Brazil (Amazônas, Rondônia, Acre and Pará).

Discussion. — Leonard (1953:291) first noted that *Pachystachys spicata* (*P. riedeliana*) has often been confused with *P. coccinea* (Aublet) Nees of French Guiana and northern Amazonian Brazil. He further states: "Although the two species are superficially similar, they can readily be separated by the longer, linear calyx segments of *P. coccinea*."

Only one chromosome count has been obtained for a species of *Pachystachys*, that by Takizawa (1957), for *P. spicata*, reported by him as *Justicia coccinea*, of $n = 16$.

Pachystachys rosea Wasshausen, sp. nov
Fig. 4

Frutex, caules subquadrangulares, brunneoli, glabri vel parce puberuli; lamina fo-

liorum elliptica vel anguste ovata, acuminate, basi angustata in petiolo amplexens, firma, glabra; spicae terminales, solitariae, rachidi puberula; bracteae imbricatae, viridae, anguste ovatae, glanduloso-pilosae; bracteolae minutae, lineares, glabrae; calyx campanulatus, segmenta anguste lanceolata, minute puberula; corolla rosea, glabra vel parce puberula, glanduloso-punctata, tubo leviter curvato, labio superiore erecto, conduplicato, bilobato, labio inferiore trilobato, lobis patulis, obtusis, ciliatis, lobis lateralibus ellipticis vel oblongis, lobo medio elliptico.

Shrub, 3 m tall; stem subquadrangular, brownish, glabrous or sparingly puberulous; leaf blades petiolate; elliptic to narrowly ovate, 15–22 cm long, 5–7.5 cm wide, acuminate at apex, narrowed from below middle to rounded, clasping base 5 mm wide, entire, undulate, moderately firm, glabrous, cystoliths conspicuous; petioles 2.5–6.5 cm long, glabrous or sparingly and inconspicuously puberulous; inflorescence consisting of solitary, terminal spike 15–25 cm long, rachis puberulous; bracts imbricate, green, narrowly ovate, 2.2–2.5 cm long, 8–9 mm wide, acuminate and mucronulate at apex, gradually narrowed and attenuate at base, glandular-pilose and ciliate, eglandular hairs intermixed with glandular ones; bractlets minute, linear, 2 mm long, 0.4 mm wide, glabrous, ciliate; calyx campanulate, 9 mm long, segments narrowly lanceolate, 8 mm long, 1 mm wide near base, sparingly and inconspicuously puberulous and ciliate; corolla pink to orange-red, 6–6.5 cm long, glabrous or sparingly and inconspicuously puberulous, glandular punctate, tube slightly curved, 4 mm wide at base, narrowed to 2 mm at 7 mm above base, thence gradually enlarged to 9 mm at throat, upper lip erect, conduplicate, ovate, 2.5 cm long, 1.2 cm wide near base, gradually narrowed to 2.5 mm at tip, 2-lobed, lobes orbicular, 1 mm long and wide, obtuse, lower lip deeply 3-lobed, lobes spreading, obtuse and ciliate, lateral pair elliptic to oblong, 16 mm long,

6 mm wide, middle lobe elliptic, 18 mm long, 6 mm wide; stamens attached near base of corolla tube, filaments 5 cm long, sparingly puberulous, anthers 6 mm long, deeply sagittate, basal lobes muticous; staminodes rudimentary, puberulous; ovary glabrous; capsule wanting.

Type.—PERU: Cuzco: Prov. Paucartambo, between Pilcopata and Carbón, 720 m, Vargas C. 23159 (holotype US).

Paratype.—PERU: Cuzco: Prov. Paucartambo, Atalaya, near junction of Río Carbón with Río Alto Madre de Dios, Foster 2398 (F, US).

Hillside and riverbank, as well as margin of rainforest.

Discussion.—*Pachystachys rosea* is perhaps nearest in relationship to the rather widespread *P. spicata*, but differs markedly in that the latter species has triangular calyx segments about 3 mm long, a scarlet corolla which may become orange-red with age, and lower corolla lip lobes which are all linear and 3–4 mm wide. In contrast, *P. rosea* has lanceolate calyx segments 8 mm long, a corolla that is pink to possibly orange-red with age, and lower corolla lip lobes of which the lateral pair is elliptic to oblong and the middle lobe elliptic (all are 6 mm wide).

Pachystachys killipii Wasshausen, sp. nov.

Figs. 6, 10

Frutex; caules teres, brunneoli, glabri; lamina foliorum elliptica vel ovata, acuminate, basi cuneata, modice firma, glabra; spicae terminales, solitariae, rachidi dense pilosa; bracteae laxae imbricatae, late ellipticae, acuminatae et mucronulatae, dense glanduloso-pilosae; bracteolae lineares, pilosae; calyx campanulatus, segmenta lanceolata, glabra, ciliolata; corolla subrosea rubra, tubo leviter curvato, praecipue prope basin hirsuto, labio superiore erecto, oblongo usque anguste lanceolato, minute bilobato, labio inferiore trilobato, lobis patulis, lobis lateralibus oblongis vel anguste ovatis, lobo medio ovato, conduplicato et obtuso.

Erect shrub 1 m tall; stem terete, brown-

ish, glabrous; leaf blades elliptic to ovate, 10.5–18 cm long and 3.5–6 cm wide, acuminate at apex, narrowed and cuneate at base, moderately firm, entire or undulate, glabrous, cystoliths numerous both above and below; petioles 0.6–2.5 cm long, glabrous; inflorescence consisting of terminal, solitary spike 15 cm long, rachis densely pilose; bracts rather loosely imbricate, green, broadly elliptic, 1.7 cm long, 6–7.5 mm broad, acuminate and mucronulate at apex, gradually narrowed at base and attenuate, rather densely glandular-pilose, glands purplish; bractlets linear, 11 mm long, 1.25 mm wide, pilose, bearing few glandular trichomes near apex; calyx campanulate, 12 mm long, segments lanceolate, 10 mm long and 1 mm wide near base, acuminate, bearing small mucro at apex, glabrous and ciliate; corolla pinkish-red, 6.5–7 cm long, tube slightly curved, 4.5 mm wide at base, narrowed to 1.5 mm at 10 mm above base, thence gradually enlarged to 1 cm at throat, hirsute, especially near base, upper lip erect, oblong to narrowly lanceolate, 2.2 cm long, 7 mm wide near base, gradually narrowed to 1 mm at tip, minutely 2-lobed, lobes obtuse, lower lip 3-lobed, lobes spreading, lateral pair oblong to narrowly ovate, 17 mm long, 5 mm wide, rounded at tip, middle lobe ovate, 12 mm long and 5.5 mm wide, conduplicate and obtuse; stamens attached near base of corolla tube, filaments 5 cm long, glabrous, anthers 6 mm long, deeply sagittate, basal lobes muticous; pollen grains 46 μ m long, 45 μ m wide, tricolporate, each mesocolpium with two colpoid streaks, membrane densely granular, sexine supracreticulate, reticulation heterobrochate (Fig. 10); staminodes none; ovary glabrous; capsule wanting.

Type. — PERU: Junín: Puerto Bermudez, 355 m, Killip & Smith 26621 (holotype US; isotype NY).

Occasional along clay river bank.

Discussion. — *Pachystachys killipii* is characterized by a combination of a pink-

ish-red corolla 6.5–7 cm long, rather small, loosely imbricate, glandular-pilose bracts 1.7 cm long, 6–7.5 mm broad, and a relatively large, campanulate calyx with the segments 12 mm long and bearing a small mucro at the tip. It is a pleasure to name this species for Ellsworth "Buddy" Killip, who through his extensive field work, has added so much to our knowledge of South American floras.

Pachystachys ossolae Wasshausen, sp. nov.

Figs. 9, 10

Suffrutex, scandens; caules subquadrangulares, brunneoli, glabri; lamina foliorum elliptica vel ovata, brevi-acuminata, basi angustata in petiolo amplexens, modice firma, glabra; spicae terminales, solitariae, rachidi puberula; bractae imbricatae, viridae apice purpureae, oblanceolatae, mucronulatae, parce puberulae; bracteolae lanceolatae; calyx campanulatus, segmenta lanceolata, puberula, ciliolata; corolla coccinea, puberula et glanduloso-punctata, tubo leviter curvato, labio superiore erecto, ovato, bilobato, lobis obtusis, labio inferiore profunde trilobato, lobis patulis, paribus lateralibus oblongis vel anguste ovatis, obtusis, lobo medio anguste ovato, conduplicato et obtuso.

Climbing, suffrutescent shrub, 0.7–4 m tall; stem subquadrangular, brownish, glabrous; leaf blades petiolate, elliptic to ovate, 17–30 cm long and 7–12 cm wide, short-acuminate at apex, narrowed from below middle to a rounded, clasping base 10 mm wide in larger leaves, entire or undulate, moderately firm, glabrous, cystoliths inconspicuous; petioles 3–8 cm long, glabrous; inflorescence consisting of solitary, terminal spike 12–20 cm long, rachis puberulous; bracts imbricate, green with purple at tips, oblanceolate, 2–2.8 cm long, 0.6–1 cm broad, acute and mucronulate at apex, gradually narrowed and attenuate at base, sparingly puberulous and ciliate, cystoliths prominent without; bractlets lanceolate, 6 mm long, 1 mm wide, puberulous and cil-



Fig. 9. A–D, *Pachystachys ossolae* (Wasshausen & Encarnación 729). A, Habit; B, Bract, bractlets and calyx; C, Corolla and exserted stamens; D, Corolla expanded, showing attachment of filaments.

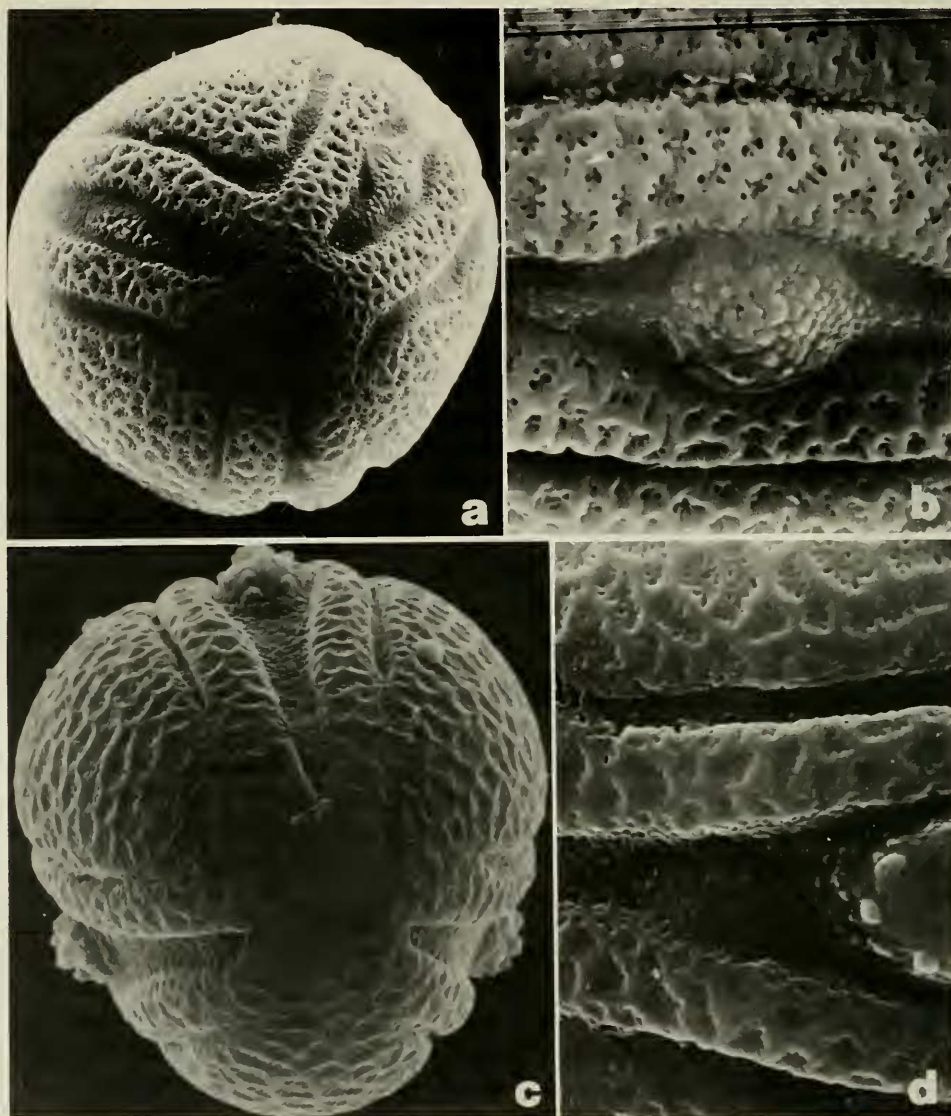


Fig. 10. SEM photomicrograph of *Pachystachys* pollen. A–B, *Pachystachys killipii* (Killip & Smith 26621); C–D, *Pachystachys ossolae* (Wasshausen & Encarnación 741). A, Polar orientation, $\times 1000$; B, Portion of surface, including pore at $\times 3000$; C, Polar orientation, $\times 1700$; D, Portion of surface, including colpus and pseudocolpi at $\times 3000$.

iate; calyx campanulate, 7 mm long, segments lanceolate, 5 mm long and 1.5 mm wide near base, puberulous and ciliate; corolla crimson, 7 cm long, puberulous and glandular punctate, tube slightly curved, 4 mm wide at base, narrowed to 2.5 mm at 8 mm above base, thence gradually enlarged

to 1 cm at throat, upper lip erect, ovate, 2.2 cm long, 9 mm wide near base, gradually narrowed to 2.7 mm at tip, 2-lobed, lobes obtuse, 1.5 mm long, 1.2 mm wide, lower lip deeply 3-lobed, lobes spreading, lateral pair oblong to narrowly ovate, 2 cm long, 5 mm wide, obtuse, middle lobe narrowly

ovate, 18 mm long and 4.5 mm wide, conduplicate and obtuse; stamens attached near base of corolla tube, filaments 5.5 cm long, puberulous, anthers yellow, 5.5 mm long, deeply sagittate, basal lobes muticous; pollen grains prolate, 53 μ m long, 35 μ m wide, tricolporate, each colpus flanked by two pseudocolpi, tectum almost complete, psilate-punctate (Fig. 10); staminodes none; ovary glabrous; capsule wanting.

Type.—PERU: Cuzco: Prov. de Quisicanchis, 3 km E of Quincemil, 960 m, *Wasshausen & Encarnación* 729 (holotype US; isotypes USM, US-3).

Additional specimens.—PERU: Cuzco: 25 km SW of Quincemil, 1340 m, *Wasshausen & Encarnación* 741 (US); 5 km E of Quincemil, 960 m, *Wasshausen & Encarnación* 833 (US). Madre de Dios: 17 km N of Pilcopata, near Río Carbón, 480 m, *Gentry, Dillon, Aronson & Berry* 23588 (MO). Parque Nacional del Manu, Río Manu, Cocha Cashu Station, 350 m *Terborgh & Foster* 6499 (F). Puno: Prov. de Carabaya, San Gabán, *Lechler* 2501 (K); vicinity of San Gabán, 900 m, *Wasshausen & Salas* 1246 (US, USM); below San Gabán on Río San Gabán, 500–1000 m, *Dillon, Aronson, Herra & Berry* 1215 (MO); San Gabán to Ollachea, 1000–2000 m, *Dillon, Aronson, Herra & Berry* 1249 (MO); Ollachea-San Gabán road, Arica, *Boeke & Boeke* 3141 (NY).

Occasional, along edge of lowland rainforest.

Discussion.—*Pachystachys ossolae* is nearest in relationship to the widespread species *P. spicata*, but differs markedly in that the latter species has a glabrous to sparingly hirtellous corolla 5.5–7 cm long, green, ovate-lanceolate, acuminate bracts, and narrowly triangular calyx segments about 3 mm long. In contrast, *P. ossolae* has a puberulous and glandular punctate corolla 7 cm long, green with distinctly purple, oblanceolate, acute and mucronulate bracts, and lanceolate calyx segments about 5 mm long.

It is a great pleasure to name this new

species for my good friend and confidant, the late Charles A. Ossola, in recognition for his outstanding dedication and devotion to the advancement of systematic biology.

Pachystachys coccinea (Aubl.) Nees in DC. Prodr. 11: 319. 1847.

Justicia coccinea Aubl. Guyan. 1: 10, pl. 3. 1775. *Jacobinia coccinea* (Aubl.) Hiern in Warm. Symb. 23: 690. 1877.

Shrub 1–2 m tall; branches puberulous when young, soon glabrous, constricted and easily broken just above nodes, bark thin and usually striate; leaves petiolate, blades elliptic to oblong-obovate, 18–25 cm long and 6–9 cm wide, acuminate (often abruptly so) at apex, when not elliptic, narrowed from above middle to acute or obtuse base, entire or undulate, glabrous except costa and lateral veins, these puberulous but soon glabrescent, cystoliths 0.25 mm long; petioles 2–6 cm long, glabrous; inflorescence consisting of terminal spike 9–22 cm long bearing conspicuous bracts and flowers, peduncles 1–3 cm long; bracts green, ovate to lanceolate, 1.5–2.5 cm long and 4–9 mm wide, lower bracts decussate, upper ones ternate and quaternate, narrower, all acute or subacuminate, apiculate, abruptly narrowed to short-winged base, more or less puberulent, usually glandular, margins and costa short-pubescent; bractlets linear-lanceolate, 5 mm long, 0.5 mm wide, puberulous; calyx campanulate, 5.5–6 mm long, slightly irregular, tube 1 mm long, segments lanceolate, equal, 5 mm long, 0.5 mm wide, sparingly and inconspicuously puberulent; corolla bright red, 5–7 cm long, rather sparingly pubescent with minute spreading hairs (hirtellous), 4 mm wide at base, narrowed to 3 mm above base, 7–10 mm wide at throat, upper lip erect, 2–2.5 cm long, emarginate, lobes 1 mm long and 0.5 mm wide, lower lip oblong, obtuse, 1.7–2 cm long, 4–5 mm wide; filaments 5.5 cm long, mature white-pubescent, densely so below, sparing-



Fig. 11. Isotype of *Pachystachys nutans* Nees (Ehrenbers 1060, BM).

ly so above; staminodes when present minute, vestigial; ovary and style glabrous.

Material.—FRENCH GUIANA: Massif des Emerillons, centre N Sources de l'Approuague, ca. 250 m, *Cremers* 6707 (CAY, US); Cayenne, *Aublet* s.n. (BM, holotype of *Justicia coccinea* Aubl.); *Rothery* 489 (K); Rorota, île de Cayenne, *Prévost* 1259 (CAY, US); vicinity of Cayenne, Montagne de Mahury, *Sagot* s.n. (K); 50–150 m, *Maas, Mennega & Koek-Noorman* 2215 (NY, US); Matabon, *Broadway* 509 (NY, US); Mt. Bruyere, 4°5'N, 51°43'W, *Irwin, Egler & Pires* 47334 (NY, US); Village Kaw, *Black & D'Age* 54-17539 (IAN, US). Without

exact locality: Jul 1824, *Poiteau* s.n. (K, photo F, US); 1842, *Melinon* 263 (GZU, P, US); 1850, *Leprieux* s.n. (P, US); *Perrottet* 204 (GZU). BRAZIL: Territorio Amapa: Río Oiapoque, Mt. Tipac, 3°36'N, 51°19'W, 0–100 m, *Irwin* 48661 (NY, US); Porto Grande, Região do Vila Nova, *Rosa* 1051 (MG, NY, US). Pará: Belém, *Pires* 14.871 (IAN, US).

Common in shade of forest clearings and margins at elevations between 50 and 250 meters.

Discussion.—*Pachystachys coccinea* is a very showy and beautiful species, with its large, conspicuously bracted terminal spike

and bright red corollas. The species is nearest in relationship to *P. spicata*. The major difference between the two species is discussed under the latter species.

Excluded Species

Pachystachys nutans Nees in DC., Prodr. 11: 320. 1847, \equiv *Jacobinia nutans* (Nees) Hemsley, Biol. Centr. Amer., Bot. 2: 521. 1882. This species, based on *Ehrenberg 1060* (holotype B, destroyed; isotype BM, sterile; fragment GZU), is known only from the type locality, Mexico, Barranca de Río de Tolimea, near Ajuntas in Caracol (Fig. 11).

The description by Nees states that the plant is suffrutescent, pubescent; stem slender, very much branched; leaf blades ovate, 2.4–2.8 cm long, attenuate and obtuse at apex, short-acute at base, costa hirtellous; petioles 6–8 mm long; inflorescence terminal, sessile, short, dense, nodding, branched spike; bracts pale green, ovate, cuspidate-mucronulate at apex, membranous, ciliate; bractlets linear-subulate; calyx rather short; corolla short, apparently purple.

The ultimate disposition of this taxon must await the recollecting of additional material.

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Literature Cited

- Bremekamp, C. E. B. 1938. Notes on the Acanthaceae of Surinam.—Recueil des Travaux Botaniques Néerlandais 35:130–171.
- Leonard, E. C. 1953. The Acanthaceae of Colombia II.—Contributions from the United States National Herbarium 31:119–322.
- Lindau, G. 1893. Beiträge zur Systematik der Acanthaceen.—Botanische Jahrbücher 18:36–64, pls. 1, 2.
- Nees von Esenbeck, C. G. 1847. Acanthaceae. In K. F. P. von Martius, Flora Brasiliensis 9:6–163, pls. 1–31.
- . 1847. Acanthaceae. In A. P. de Candolle, Prodrum Systematis Naturalis Regni Vegetabilis 11:46–519.
- Rizzini, C. T. 1947. Estudos Sobre As Acanthaceae.—Boletim do Museu Nacional, Rio de Janeiro 8:1–38, pls. 1–11.
- Takizawa, Y. 1957. Die Struktur der Pachytänchromosomen einiger Acanthaceen, sowie eine Reihe neu bestimmter Chromosomenzahlen.—Cytologia 22:118–126.

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